

Erin J. Leonard, Ph.D.

Research Scientist

Planetary Geosciences Group (3223)

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About

Erin Leonard is a research scientist in the Planetary Geoscience group at the Jet Propulsion Laboratory, California Institute of Technology. Her research focuses on geomorphologic mapping of icy satellites, structural analysis of the surface features, and how these surface observations can lead to implications for the subsurface or evolution of the body. Erin is the lead author on the new global geologic map of Europa for the United States Geologic Survey (USGS). She also has a particular interest in the Ice Giant systems, with an emphasis on detecting and characterizing Ocean Worlds, and actively aids in formulating and advocating for missions to these systems. Inspired by the work she has done for Europa Clipper Project Science, Erin is also interested in the interface between science and engineering, especially as it relates to operations, systems engineering, and management.

Education

June 2019 Ph.D., Planetary Geology, University of California Los Angeles

May 2014 B.S., Astrophysics and Planetary Science, University of California Berkeley

Professional Experience

2022 – *pres.* Project Staff Scientist, Europa Clipper

2022 – *pres.* Plumes Focus Group Facilitator, Europa Clipper

2023 – *pres.* Deputy Project Scientist, New Frontiers 5 Mission Concept

2021 – 2023 Science Sampling Task Lead, Europa Lander Pre-Project

2019 – 2022 JPL Postdoctoral Fellow

2019 – 2022 Europa Clipper Project Science Postdoctoral Affiliate

2017 – 2019 Europa Clipper Project Science Graduate Affiliate

2014 – 2019 Graduate Researcher & Teaching Assistant at UCLA in the Earth, Planetary, and Space Sciences (EPSS) Department

Funded Activities

2024 NASA ROSES NFDAP PI – JunoCam at Europa (PI – self, 3 years)

2023 NASA ROSES PDART PI – Europa Regional Geologic Mapping (PI – self, 3 years)

2022 JPL Topical RTD Co-I – Enceladus Subsurface Plumbing (PI – S. Howell, 2 years)

Awards

2023

2023 JPL Team Award – Europa Clipper PSG 12

2021 JPL Voyager Award - Europa Clipper Rules of the Road

2019 NASA Group Achievement Award - Europa Global Geologic Map

- 2018 UCLA EPSS Excellence in Academic Performance and Research Potential
- 2018 Early Career Travel Award – Outer Planets Assessment Group (OPAG)
- 2017 Paul M. Furukawa Memorial Fellowship Award
- 2016, 2017 Excellence in Teaching Award Awarded by UCLA
- 2016 Planetary Interiors Short Course Scholar and Travel Awardee, International School of Space Science (ISSS)
- 2016 NSF Graduate Research Fellowship Honorable Mention

Professional Activities

- 2023 Co-organizer and co-convenor, “Europa Clipper”, American Geophysical Union (AGU) Fall Meeting
- 2024 Co-organizer, “The Ice Giants: Exploring the Planetary Systems of Uranus and Neptune”, American Geophysical Union (AGU) Fall Meeting
- 2023 Co-organizer of the “Uranus Flagship 2023” Workshop at Caltech in July 2023
- 2023 Primary Convener, “Ice Giant System Science and Exploration” European Geophysical Union (EGU) Spring Meeting
- 2022 – 2023 Co-Convener, “The Ice Giants: Exploring the Planetary Systems of Uranus and Neptune”, American Geophysical Union (AGU) Fall Meeting
- 2022 – *pres.* Geologic Mapping Subcommittee (GEMS)
- 2022 – *pres.* Member of NASA RCN, Network for Ocean Worlds (NOW)
- 2021 – 2023 Co-Writer of Europa Lander Terrain Specification Document (TSD)
- 2021 Co-organizer and Primary Convener of “In Situ Science and Instrumentation for the Exploration of Europa and Ocean Worlds” Oral and Poster sessions at American Geophysical Union (AGU) Fall Meeting
- 2020 – *pres.* Lead Editor of the Europa Clipper Rules of the Road (RoTR) Document
- 2020 – *pres.* Co-Organizer and Chair of “Friends of Hoth: Geology of Icy Satellites and Small Bodies” at Geological Society of America Fall Meetings (annually)
- 2019 – 2023 Co-Organizer of ICE (Icy Collaboration and Exchange) seminar series
- 2019 – 2022 Member of NRSB (New Researchers Support Group)
- 2018 – *pres.* Review panelist for NASA Grant Proposals, ~1 per year.
- 2018 Project Manager of JPL’s Planetary Science Summer Seminar (PSSS), Uranus Orbiter for New Frontiers JPL. Advisors: Charles Budney and Karl Mitchell
- 2017 Science Expert for JPL A-Team RPS Ocean/Ice Exploration Study, JPL.
- 2013 – 2014 Planning observations and imaging of Type 1a supernovae

Outreach

- 2024 Invited Speaker at the Burbank Public Library – Europa Clipper
- 2024 Invited Speaker at Los Angeles Valley Community College – Europa Clipper
- 2023 – *pres.* Mentored four students at Clovis Community College with Prof. Michelle Selvans
- 2021 Society for Science Regeneron High School Science Talent Search Evaluator
- 2021 Advisor for MIT 16.83 Enceladus Mission Class
- 2019 Panelist for Long Beach Comic Con – Women in Planetary Science
- 2018 Explore Your Universe (EYU) Booth Organizer – Cassini at Enceladus
- 2017 UCLA Grad Slam Finalist <https://www.youtube.com/watch?v=nCg6QI2cyV8>

Publications

- E. J. Leonard**, D. A. Patthoff, and D. A. Senske (2024). The Europa Global Geologic Map. *United States Geologic Survey*.
- Hansen, C.J., Ravine, M.A., Schenk, P.M., Collins, G.C., **Leonard, E.J.**, Phillips, C.B., Caplinger, M.A., Tosi, F., Bolton, S.J. and Jónsson, B., 2024. Juno's JunoCam Images of Europa. *The Planetary Science Journal*, 5(3), p.76.
- Daubar, I.J., (incl. **Leonard, E. J.**) et al. 2024. Planned geological investigations of the Europa Clipper Mission. *Space Science Reviews*, 220(1), p.18.
- Howell, S.M., Bierson, C.J., Kalousová, K., **Leonard, E. J.**, Steinbrügge, G. and Wolfenbarger, N., 2024. Jupiter's ocean worlds: Dynamic ices and the search for life. In *Ices in the Solar-System* (pp. 283-314). Elsevier.
- Park, R.S., Mastrodemos, N., Jacobson, R.A., Berne, A., Vaughan, A.T., Hemingway, D.J., **Leonard, E. J.**, Castillo-Rogez, J.C., Cockell, C.S., Keane, J.T. and Konopliv, A.S., 2024. The global shape, gravity field, and libration of Enceladus. *Journal of Geophysical Research: Planets*, 129(1), p.e2023JE008054.
- Cockell, C.S., Simons, M., Castillo-Rogez, J., Higgins, P.M., Kaltenecker, L., Keane, J.T., **Leonard, E. J.**, Mitchell, K.L., Park, R.S., Perl, S.M. and Vance, S.D., 2023. Sustained and comparative habitability beyond Earth. *Nature Astronomy*, pp.1-9.
- Leonard, E. J.**, Beddingfield, C.B., Elder, C.M. and Nordheim, T.A., 2023. Unraveling the Geologic History of Miranda's Inverness Corona. *The Planetary Science Journal*, 4(12), p.235.
- Vance, S.D., et al. (incl. **Leonard, E. J.**) 2023. Investigating Europa's Habitability with the Europa Clipper. *Space Science Reviews*, 219(8), p.81.
- Beddingfield, C.B., **Leonard, E. J.**, Nordheim, T.A., Cartwright, R.J. and Castillo-Rogez, J.C., 2023. Titania's Heat Fluxes Revealed by Messina Chasmata. *The Planetary Science Journal*, 4(11), p.211.
- Roberts, J.H., et al. (incl. **Leonard, E. J.**) 2023. Exploring the interior of Europa with the Europa Clipper. *Space Science Reviews*, 219(6), p.46.
- Howell, S., and **E. J. Leonard** (2023). *Ocean Worlds: Interior Processes and Physical Environments*, NASA Handbook of Space Resources, *Springer Publishing*.
- Beddingfield, C.B., Cartwright, R.J., Ferguson, S.N. and **Leonard, E.J.**, 2023. Tethys's Heat Fluxes Varied with Time in the Ithaca Chasma and Telemus Basin Region. *The Planetary Science Journal*, 4(3), p.57.
- Mills, M.M., Pappalardo, R.T., Panning, M.P., **Leonard, E.J.** and Howell, S.M., 2023. Moonquake-triggered mass wasting processes on icy satellites. *Icarus*, p.115534.
- Schoenfeld, A.M., Hawkins, E.K., Soderlund, K.M., Vance, S.D., **Leonard, E.** and Yin, A., 2023. Particle entrainment and rotating convection in Enceladus' ocean. *Communications Earth & Environment*, 4(1), p.28.
- Wynne, J.J., Mylroie, J.E., Titus, T.N., Malaska, M.J., Buczkowski, D.L., Buhler, P.B., Byrne, P.K., Cushing, G.E., Davies, A.G., Frumkin, A. and Hansen-Koharcheck, C., (incl. **Leonard, E. J.**). 2022. Planetary caves: A solar system view of processes and products. *Journal of Geophysical Research: Planets*, 127(11), p.e2022JE007303.

- Beddingfield, C.B., **E. J. Leonard**, Cartwright, R.J., Elder, C. and Nordheim, T.A. (2022). High Heat Flux near Miranda's Inverness Corona Consistent with a Geologically Recent Heating Event. *The Planetary Science Journal*, 3(7), p.174.
- Beddingfield, C.B., Cartwright, R.J., **E. J. Leonard**, Nordheim, T. and Scipioni, F. (2022). Ariel's Elastic Thicknesses and Heat Fluxes. *The Planetary Science Journal*, 3(5), p.106.
- Zheng, W., **et al.**, 2022. The Lick Observatory Supernova Search follow-up program: photometry data release of 70 SESNe. *Monthly Notices of the Royal Astronomical Society*, 512(3), pp.3195-3214.
- E. J. Leonard**, Howell, S., Mills, A., Senske, D.A., Patthoff, D.A., Hay, H.C.F.C. and Pappalardo, R.T., 2022. Finding order in chaos: Quantitative predictors of chaos terrain morphology on Europa. *Geophysical Research Letters*, p.e2021GL097309.
- Cartwright, Richard J., **et al.**, 2022. A CO₂ Cycle on Ariel? Radiolytic Production and Migration to Low-latitude Cold Traps. *The Planetary Science Journal*, 3(1), p.8.
- Howell, S., and **E. J. Leonard** (2021, in press). Ocean Worlds: Interior Processes and Physical Environments, Handbook of Space Resources, Springer Publishing.
- E. J. Leonard**, et al., 2021. UMaMI: A New Frontiers-style Mission Concept to Explore the Uranian System. *The Planetary Science Journal*, 2(5), p.174.
- Cartwright, Richard J., **et al.**, 2021. The science case for spacecraft exploration of the Uranian satellites: Candidate ocean worlds in an ice giant system. *The Planetary Science Journal*, 2(3), p.120.
- Titus, T.N., **et al.** 2021. A roadmap for planetary caves science and exploration. *Nature Astronomy*, 5(6), pp.524-525.
- E. J. Leonard**, A. Yin, and R. T. Pappalardo (2021). Forming Relic Cratered Blocks: Left-Lateral Shear on Enceladus Inferred From Ice-Shell Deformation in the Leading Hemisphere. *Journal of Geophysical Research: Planets*, 126(2), e2020JE006499.
- E. J. Leonard**, C. Elder, T. Nordheim, R. Cartwright, D. A. Patthoff, C. Beddingfield, M. Tiscareno, N. Strange, and T. Balint, and 98 cosigners (2020). A New Frontiers Class Mission for the Uranian System that Focuses on Moon, Magnetosphere, and Ring Science. *White Paper submitted in Response to the Planetary Science and Astrobiology Decadal Survey 2023–2032*.
- E. J. Leonard**, Yin, A., and Pappalardo, R. T. (2020). Ridged Plains on Europa Reveal a Compressive Past. *Icarus*. p.113709.
- S. Jarmak, **E. J. Leonard**, et al. (2020). QUEST: A Mission Concept for a New Frontiers Style Uranus Orbiter. *Acta Astronautica*, 170, pp.6-26.
- T. deJaeger, **et al.** (2019). The Berkeley sample of Type II supernovae: BVRI light curves and spectroscopy of 55 SNe II. *MNRAS*, 490(2).
- B. E. Stahl, **et al.** (2019). Lick Observatory Supernova Search Follow-Up Program: Photometry Data Release of 83 Type Ia Supernovae. *MNRAS*, 490(3), pp.3882-3907.
- E. J. Leonard**, R. T. Pappalardo, and A. Yin (2018). Structural analysis of very-high-resolution Galileo images of Europa: Implications for surface evolution. *Icarus*, 312, pp.100-120.

Manuscripts in prep.

- E. J. Leonard**, D. A. Senske, D. A. Patthoff (*in prep*). The Global Geologic Map of Europa: An analysis of global surface features. *Icarus* (planned).

Invited Talks

- E. J. Leonard** (2023). Europa's Geology: The Cover Art of an Enigmatic Moon. Making Space: A Workshop on Space, SciArt, and Society. July, 2023.
- E. J. Leonard** (2023). Inferring Europa's resurfacing history through potential impurity layers within the ice shell. Japan Geosciences Union (JpGU). May, 2023.
- E. J. Leonard** (2023). Bringing Order to Chaos: Insights on the Formation of Chaos Terrain and Implications for Ice Shell Evolution. Brown University, Earth, Environmental, and Planetary Science Department Seminar. March, 2023.
- E. J. Leonard** (2023). Bringing Order to Chaos: Insights on the Formation of Chaos Terrain from Geologic Mapping of Europa and Implications for Ice Shell Evolution. California Institute of Technology, DIX Planetary Science Seminar. January, 2023.
- E. J. Leonard** (2022). Mapping Everything Europa: Clipper Team Policies to Geology. Group Meeting for 398P. January 10th, 2022.
- E. J. Leonard** (2021). Bringing Order to Chaos: Insights on the Formation of Chaos Terrain from Geologic Mapping of Europa at the Global and Regional Scale. University of Chicago, September 30th, 2021
- E. J. Leonard** (2021). Bringing Order to Chaos: Insights on the Formation of Chaos Terrain from Geologic Mapping of Europa at the Global and Regional Scale. University of North Carolina Wilmington, February 26th, 2021
- E. J. Leonard** (2019). Compositional Variations within Europa's Ice Shell: Implications for Surface Geology. Europa Clipper Science Series at JPL, April 19th, 2019
- E. J. Leonard**, Pappalardo, R.T. and Yin, A., (2018). Forming Ridges on Icy Satellites: Insights from Physical Analogue Modeling. GSA Fall Meeting, 2018, pp.P42B-08.
- E. J. Leonard** (2018). Europa at all Scales: Analyzing Global to High-Resolution Images to Constrain Surface Evolution. Planetary Science Seminar at CalTech, Oct. 2nd 2018.
- E. J. Leonard** (2018). Europa's Geology: Insights from Geologic Mapping at the Global to Local Scale. Europa Clipper Science Series at JPL, July 13th 2018.
- E. J. Leonard** (2018). "Europa at all Scales: Analyzing Global to High-Resolution Images to Constrain Surface Evolution". Planetary Science Seminar at UCLA, April 12th 2018.
- E. J. Leonard**, D. A. Patthoff, and D. A. Senske (2017). "The First USGS Global Geologic Map of Europa." Hyperwall Presentation at AGU Fall Meeting in New Orleans, LA, December 2017. (<https://www.youtube.com/watch?v=jd7rHQOxRiM>)
- E. J. Leonard**, D. A. Patthoff, and D. A. Senske (2017). "The First USGS Global Geologic Map of Europa." Hyperwall Presentation at GSA Fall Meeting in Seattle, WA, October 2017.